Allocation of Time and Resources by Married Couples Approaching Retirement

by Robert L. Clark, Thomas Johnson, and Ann Archibald McDermed*

The work and retirement decisions of husbands and wives are likely to be made jointly as they allocate their available resources. This article models the allocation of family wealth and family members' time over the lifetime of the unit. The first section reports simulation results that illustrate the relationship between the value of members' time in both market work and the production of home services. The model is then tested by means of the Retirement History Study for 1969–73. The estimation is conducted by employing a simultaneous logit model of labor-force participation by the husband and wife. Principal findings are: (1) Individuals respond positively to increases in their own wage rate but tend to reduce labor-force participation as the wage rate of their spouse increases, (2) the health of the husband is an important determinant of his labor-force participation, and (3) the probability that a person will be in the labor force is rasied if the spouse is employed.

In recent years, considerable resources have been allocated to the evaluation of retirement decisions. Most of these studies have concentrated on the withdrawal of white men from the labor force. This article attempts to extend the analysis to a family framework in which the retirement decisions of the husband and wife are jointly determined. The first section describes a life-cycle model of family labor supply, consumption, and savings. Parameters are altered and the effects on decisions are illustrated. One finding is that increases in the number of hours of work by the wife caused by changes in the rental rate are associated with declines in the total amount of time that her husband spends in the market.

Because a complete life-cycle history for a sample of individuals on which to test this model was not available, the Retirement History Study of the Social Security Administration was used to estimate cross-sectional retirement equations for the years 1969–73. This procedure made it possible to observe how certain variables are associated with labor supply in later life. Though individuals may alter their retirement plans because of changes that occur in their late fifties or sixties, those alterations are not necessarily what would be produced by similar changes over the household life cycle. At the conclusion of this article, the implications of the simulation model are compared with the results of the logit analysis.

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Life-Cycle Model of Dual-Career Household

The dual-career household is modeled as maximizing the present value of the utility of a home-produced commodity over the known life of the household plus the utility of bequests at the end of the household life cycle. The present value of lifetime utility is evaluated at the moment of household formation. Utility is discounted at a constant rate ρ, the impatience rate, which is not in general equal to the market interest rate r. Provision for members surviving beyond the end of the household life cycle is made through the bequests. For simplicity of initial development, the

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marginal utility of a unit of home-produced commodity is taken to be a constant. The production of this commodity employs three inputs: the effort of each spouse and a single purchased good. Note that there is no separate "leisure" in this model. Utility is not gained just from unoccupied time but from the combination of the human-capital-augmented time of both spouses and a purchased good.

The household possesses stocks of three types of assets. Each spouse possesses a stock of human capital that depreciates at a constant rate (δ_1 and δ_2) and can be augmented through a production function combining the individual's own effort and an individual specific purchased input. The household collectively possesses a stock of nonhuman assets called bonds (B), which may be bought and sold in a perfect capital market with a constant interest rate. The value of the bonds held represents all nonhuman assets and liabilities of the household and includes the value of real estate, consumer durables, social security benefits, private pensions, and all debts. The value of the bonds possessed at the end of the household life cycle is labeled bequests. Valued at the moment of household formation, the utility of bequests is a constant times the logarithm of the bequests. Thus, a positive stock of bonds is assured at the end of the household life cycle.

The available effort of each spouse during a unit of time is divided among the three activities of home production, own human-capital production, and market work. For example, the fraction of available effort that spouse 1 devotes to home production is $S1H$ and the effort, or human-capital-augmented time that spouse 1 devotes to home production $S1H \bullet E1$, the fraction times the stock of human capital.

Household income at a given time is the sum of the net returns to the bonds possessed and the product of the market rental rate of human capital for each spouse ($R1$ for spouse 1 and $R2$ for spouse 2) times the effort which that spouse devotes to the market.

$$\text{Income} = r \bullet B + R1 \bullet S1M \bullet E1 + R1 \bullet S2M \bullet E2.$$

Note that $r\,B$ is negative if the household is a net debtor, $B < 0$. Expenditures at a given time are the sum of the expenditures on the purchased inputs in the production of the home-produced commodity plus the expenditures on the purchased inputs in the human-capital production of each spouse. Thus,

$$\text{Expenditures} = PD1 \bullet D1 + PD2 \bullet D2 + PX \bullet X$$

where X is the purchased input in the production of the home-produced commodity, $D1$ is the purchased input to the production of spouse 1's human capital, and $D2$ is a similar quantity for spouse 2. The prices, PX, $PD1$, and $PD2$, are taken as constants to the household.

Each spouse's human capital production function is represented by a Cobb-Douglas form. The human capital production function for spouse 1 is

$$Q_1(S1I \bullet E1,\ D1) = \beta_{10}\,(S1I \bullet E1)^{\beta_{11}} D1^{\beta_{12}}$$

while for spouse 2 it is

$$Q_2(S2I \bullet E2,\ D2) = \beta_{20}\,(S2I \bullet E2)^{\beta_{21}} D2^{\beta_{22}}.$$

The production function for the home-produced commodity is of translog form

$$ln\, Z(S1H \bullet E1,\ S2H \bullet E2,\ X) = ln\, \gamma_0 + \gamma_1\, ln\,(S1H \bullet E1)$$

$$+ \gamma_2\, ln(S2H \bullet E2) + \gamma_3 ln X + \gamma_4 ln(S1H \bullet E1)\, ln(S2H \bullet E2)$$

which is the simplest extension from the Cobb-Douglas form with three inputs. In this form the elasticity of substitution between the efforts of spouse 1 and spouse 2 depends on γ_4, $S1H \bullet E1$, and $S2H \bullet E2$ rather than being identically one, as in the Cobb-Douglas form.

At each moment, there are nine control variables whose values must be chosen. These variables are $S1H$, $S1I$, $S1M$, $S2H$, $S2I$, $S2M$, $D1$, $D2$ and X. These choices must satisfy the constraints.

$$S1H + S1I + S1M = 1,\quad S2H + S2I + S2M = 1.$$

The path of these control variables through the life cycle are chosen to maximize the objective function

$$\int_0^T U(Z(t))e^{-\rho t}\, dt + A\, ln(B(T))$$

where T is the length of the household life cycle, subject to the rate at which the state variables can be changed

$$\frac{dE1}{dt} = Q_1\,(S1I \bullet E1,\ D1) - \delta_1\, E1$$

$$\frac{dE2}{dt} = Q_2\,(S2I \bullet E2,\ D2) - \delta_2\, E2$$

$$dB = R1 \bullet S1M \bullet E1 + R2 \bullet S2M \bullet E2 + r \bullet B$$

$$- PD1 \bullet D1 - PD2 \bullet D2 - PX \bullet X$$

and the initial values of each stock at $t = 0$

$$E1(0) = E10,\ E2(0) = E20,\ B(0) = B0.$$

In the course of formulating a solution to the problem, a costate variable, or shadow price, is introduced corresponding to each state variable. A differential equation in each of the costate variables is also introduced. Unfortunately, the boundary conditions for these differential equations are terminal conditions at $t = T$ rather than initial conditions. Therefore, when, as in this problem, closed form analytical solutions cannot be obtained, procedures of numerical analysis must be employed. These procedures require taking a guess at the initial value of the costate variables, working through the implied life cycle, and seeing how the final results at $t = T$ correspond with the required terminal conditions. A systematic procedure is then employed to update the initial guesses to move the final results closer to the required terminal conditions.

A computer algorithm has been devised using IBM's Continuous System Modeling Program (CSMP). This program determines the values of the control variables and increments to the state and costate variables for a series of very short time intervals, thus approximating the movement of these variables through the life cycle. At the beginning of each small time increment the values of the control variables are determined from the necessary conditions given by the maximum principle of optimal control while taking the values of the state and costate variables given from the end of the previous increment. The changes over the time increment that these values of the controls would cause in the state and costate variables are then calculated and added to the values of the stocks. The procedure is repeated for the next time increment. When the end of the life cycle is reached, the resulting values of the costate variables are compared with the values required by the terminal conditions. If the terminal conditions are not satisfied, a grid search is made in the initial values of the costate variables to approximate numerically the derivative of terminal values with respect to initial values. A Newton-Raphson type algorithm is then used to obtain a new approximation of initial values that will satisfy the terminal conditions. This cycle is repeated until the terminal conditions are satisfied within small tolerances.

Numerical Results and Sensitivity Analysis

The parameter values that define the base case are given in table 1. Sensitivity analyses are given as changes in parameter values from those of the base case. The parameter values chosen for the base case are based on results of previous studies of human-capital investment using simpler models, demographic data, previous studies of retirement, data from the Retirement History Study, data on interest rates and inflation rates, and personal judgment after the values of the parameters were explored. For example, the value of A was chosen to yield reasonable values of bequests, $B(T)$. The value of 10,000 for A means that the marginal utility of $10,000 in bequests, at the time of household formation, is equal to the marginal utility of one unit of home-produced commodity consumed immediately upon household formation. The model was programmed to allow for a constant income tax rate, YTAX; the value of 0.25 chosen for the calculations represents an average tax rate of 25 percent. The interest rate r and human-capital rental rates $R1$ and $R2$ are before-tax rates and the value taken for YTAX means that the effective rates are 75 percent of the values given.

The initial values of the stocks of human capital correspond to spouse 1 being approximately age 21 and spouse 2 being approximately age 18 when the household is formed; both are assumed to be high school graduates and spouse 1 is assumed to have some college training. The value of the household horizon, $T = 52$, thus represents a life expectancy for spouse 1 of 73 years. The interest rate chosen, 3 percent, is approximately the return available on low-risk bonds, after subtracting the actual inflation rate, for the period 1930–70. The impatience rate, $\rho = 0$, was chosen for lack of a basis for any particular value. The price of purchased goods was set at 2.0 to allow for inflation during the period 1957–59 to 1970 because the studies from which the human-capital stock estimates were derived were based on data from the 1960 census and other surveys from the mid-1950's to the

Table 1.—Parameter values for the base case of the life-cycle model

Parameter	Base value	Description
A	10,000	Constant in utility of bequest $A \bullet \ln B(t)$
$U'(Z(t))$	1	Marginal utility of home-produced commodity at time t
T	52	Length of household life cycle in years
$B0$	0	Stock of bonds at time 0
$E10$	33,000	Stock of human capital of spouse 1 at time 0
$E20$	25,000	Stock of human capital of spouse 2 at time 0
$R1$	0.25	Market rental rate of human capital of spouse 1
$R2$	0.225	Market rental rate of human capital of spouse 2
r	0.03	Market interest rate on bonds
ρ	0	Household impatience rate
YTAX	0.25	Income tax rate
PX	2.0	Price of purchased input X for home production
$PD1$	2.0	Price of purchased input $D1$ for spouse 1 human-capital production
$PD2$	2.0	Price of purchased input $D2$ for spouse 2 human-capital production
β_{10}	40.0	Neutral coefficient in spouse 1 human-capital production function
β_{11}	0.3333	Own human-capital coefficient in spouse 1 human-capital production function
β_{12}	0.1666	Purchased input coefficient in spouse 1 human-capital production function
β_{20}	40.0	Neutral coefficient in spouse 2 human-capital production function
β_{21}	0.3333	Own human-capital coefficient in spouse 2 human-capital production function
β_{22}	0.1666	Purchased input coefficient in spouse 2 human-capital production function
γ_0	40.0	Neutral coefficient in home-production function
γ_1	0.125	Spouse 1 human-capital coefficient in home-production function
γ_2	0.125	Spouse 2 human-capital coefficient in home-production function
γ_3	0.25	Purchased input coefficient in home-production function
γ_4	0.01	Human capital cross product coefficient in home-production function

mid-1960's. The human-capital stock values were also corrected for inflation to approximate 1970 dollar values. No studies are available on which to base parameter values of the production function for home-produced commodities. It was reasoned that the returns to scale of home production should be approximately the same as has been estimated for human-capital production. The equal division between purchased input and the human-effort inputs and the equality between the efforts of spouses was chosen for lack of a basis for another choice.

Chart 1 presents, for the base case, the hours per week spent in market work by both spouses together with the bonds possessed by them and their total expenditures over the life cycle. The proportion of effort spent in market work was converted to hours per week by assuming that there are 100 hours per week available, beyond basic maintenance, to allocate between home production, investment in human capital, and market work. The age of spouse 1 is assumed to be 21 when the household is formed. The age of spouse 2 is 3 years less than that of spouse 1. In this model, retirement occurs when hours of market work go to zero. For the base case, spouse 1 retires at age 62 and spouse 2 retires at age 56.5.

For the base case, the trajectories of hours of market work, $S1M$ and $S2M$, are nearly parallel and both reach their maximum when spouse 1 is aged 39. The small arrows indicate the maximum points on $S1M$ and $S2M$. The maximum value of $S1M$ of approximately 59 hours per week seems reasonable, although direct comparisons cannot be made with reported hours of work. The concept of $S1M$ includes such time allocations as commuting, which are likely not to be reported as hours of work, but excludes such allocations as rest periods and learning, some of which may be reported as hours of work.

Note that expenditures increase throughout the life cycle but that the rate of increase is reduced at retirement. Mathematical analysis of life-cycle models has shown that expenditures on the purchased input to home production, X, will increase throughout the life cycle if the market interest rate is greater than the impatience rate, $r > \rho$. With $r = 0.03$ and $\rho = 0.0$, this effect strongly dominates the decline in expenditures on human capital production inputs, $D1$ and $D2$.

The trajectory for the stock of bonds possessed, B, shows the household initially going into debt but reaching a net positive asset position by the time that spouse 1 is aged 27. The value of assets peaks at over $205,000 when spouse 1 is aged 56 and declines to a final bequest level of $33,900. When the value of social security benefits and private pensions is considered, these are not unreasonably large asset values. If anything, the amount of the bequest may understate the typical value of survivor benefits plus other assets bequeathed to the younger spouse of the RHS cohort. Even this rapid decrease in B late in life is not inconsistent with constant or increasing levels of reported assets since the value of B includes social security and pension annuities, which are being depleted.

Charts 2–7 show the results of solving the model for the parameter values of the base case altered as indicated in their titles. Chart 2 presents the implications of reducing the real interest rate to 1 percent. Despite the presence of unusually high nominal interest rates in the 1970's, the decade was characterized by very low real interest rates after adjustment for inflation. The chart indicates that, when the other parameters remain unchanged, the reduction in the real interest rate from 3 percent to 1 percent would have dramatic effects on patterns of working and spending over the life cycle. Additional years are spent in school, the peak in weekly hours is lower and occurs later in life, and neither spouse retires during the life of the household. Expenditures start at a higher value and are more nearly constant throughout the life cycle. The increase in expenditures on X does not dominate the declines in expenditures on $D1$ and $D2$, causing a small decline in total expenditures in middle age. The household reaches a net debt position of $85,000 and does not reach a net positive asset position until spouse 1 is 57 years old.

The effects of lowering $R2$, the market rental rate of spouse 2, are shown in chart 3. For the base case the ratio of market rental rates is $R2/R1 = 0.9$; this ratio is lowered to 0.8 for the case presented in chart 3. The market fraction for spouse 1 increases slightly and the fraction for spouse 2 decreases slightly but no dramatic effects of this change are evident in the market demand for the human capital of spouse 2.

The effects of changing the relative productivity of the two spouses in home production are presented in chart 4. In the base case the home-production coefficients are equal, $\gamma_1 = \gamma_2 = 0.125$. For the case presented in chart 4, the sum is kept equal to 0.25 but the ratio is changed to $\gamma_2 / \gamma_1 = 1.5$. Again, as with changes in market productivity, no dramatic effects occur. Changing the parameter values to $R2/R1 = 0.6$ and $\gamma_1/\gamma_1 = 4$ simultaneously yields the results shown in chart 5. Together, these changes do cause noticeable effects. Spouse 1 never retires, spouse 2 works in the market "part time" between ages 20 and 43, and the maximum in the stock of bonds is just over $80,000. The "step" in spouse 1's market work accompanies a relatively large and rapid shift from human-capital production to home production for both spouses.

The effects of changing the elasticity of substitution between the effort in home productivity of spouse 1 and the effort of spouse 2 are shown in charts 6 and 7. The value of $\gamma_4 = 0.001$ reduces the elasticity of substitution to very near the Cobb-Douglas case noted earlier. (The program would not converge for the Cobb-Douglas case $\gamma_4 = 0.0$.) The value of $\gamma_4 = 0.02$ increases the elasticity of substitution from the base case. These results indicate that the model is sensitive to the elasticity of substitution between the efforts of the two spouses. The values of

Chart 1. — The base case: Hours per week in market work for both spouses, bonds possessed by the family, and household life-cycle expenditures

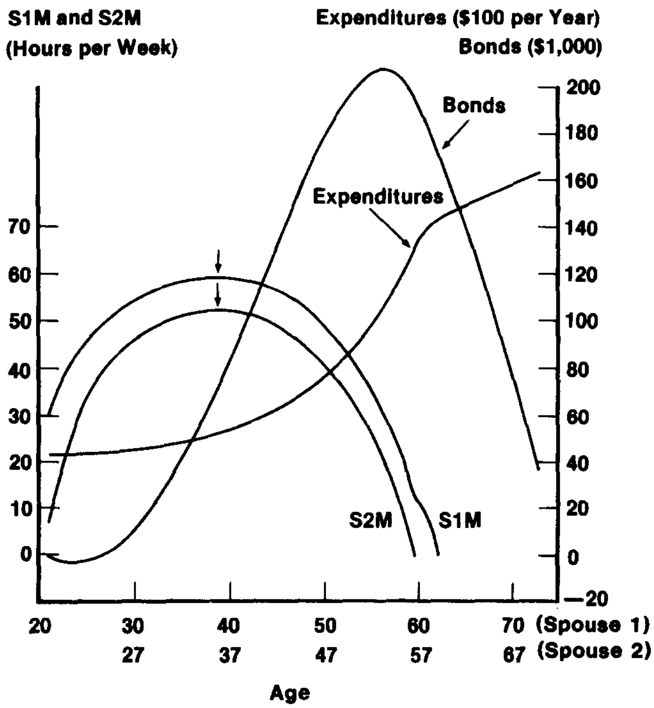


Chart 2. — Reducing real interest rate to 1 percent (r = 0.01)

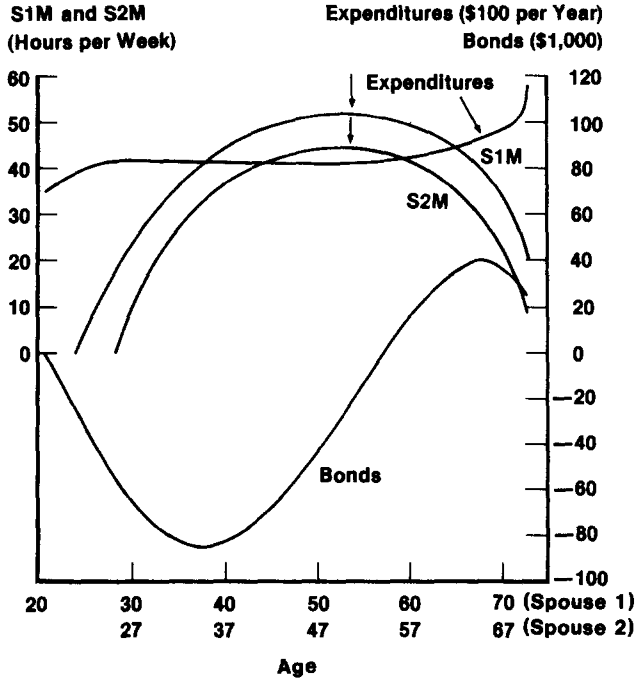


Chart 3. — Lowering the market rental rate of spouse 2 (R2 = 0.20)

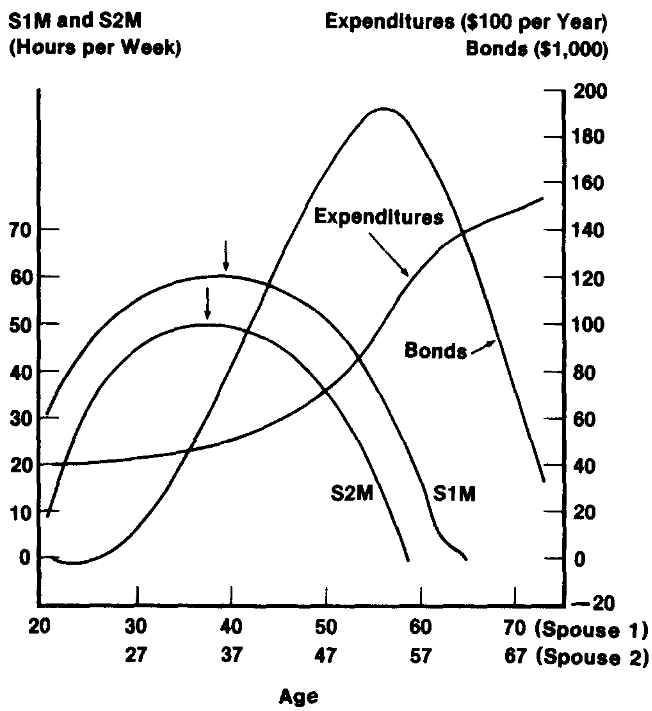
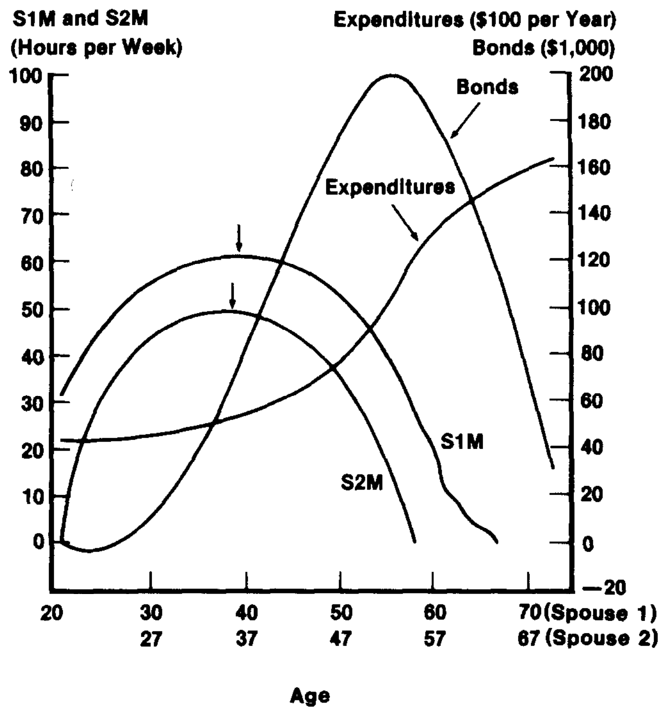


Chart 4. — Changing relative productivity of both spouses in home production ($\gamma 1 = 0.10$, $\gamma 2 = 0.15$)



human capital $E1$ and $E2$ are such that the case of complementarity between the efforts of spouse 1 and spouse 2 could not be explored. It appears that $\gamma_4 = 0.01$ was a fortuitous choice and that only values of γ_4 between 0.001 and 0.01 need be considered.

These cases with constant rental rates and home-production parameters do not describe the process of family

Chart 5. — Changing parameter values in market work and home productivity (R2=0.15, $\gamma 1=0.05$, $\gamma 2=0.20$)

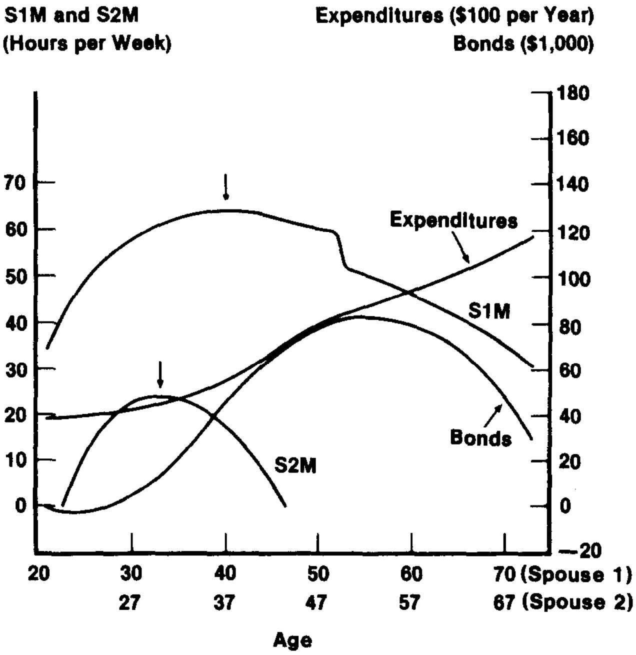


Chart 6. — Reducing the elasticity of substitution between the spouses in home productivity ($\gamma 4=0.001$)

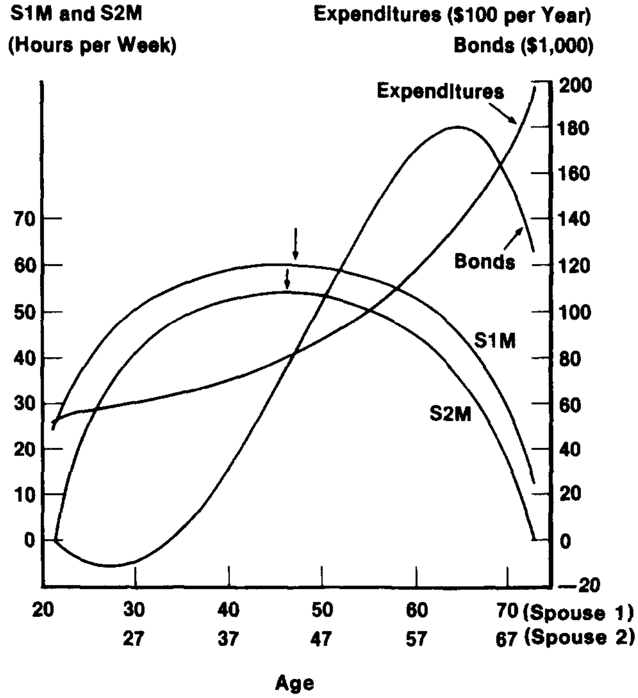
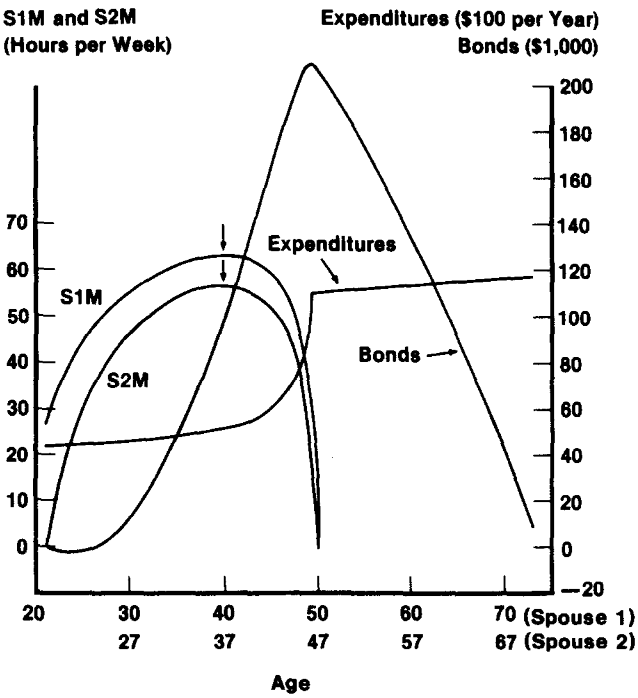


Chart 7. — Increasing the elasticity of substitution between the spouses in home productivity ($\gamma 4=0.02$)



formation well. The presence of young children might increase the home productivity and reduce, because of payments to hire child care, the effective rental rate on human capital of the spouse with the comparative advantage in home production. The computer algorithm has been modified to allow for fully anticipated changes in the home-production parameter and market rental rate for spouse 2 during a period during the life cycle. This modification also allows for reductions in rental rates for both spouses toward the end of the life cycle. These reductions in rental rates may be used to model such effects as mandatory "retirement" from a primary occupation, voluntary changes to less demanding jobs, and reduced real earnings because of the earnings test under the social security program.

Family Retirement Decisions

As in the simulation model, the analysis that follows examines the labor-supply decisions of older persons within a family framework. The sources of the data used are the 1969, 1971, and 1973 waves of the Retirement History Study (RHS) conducted by the Social Security Administration and the accompanying summary earnings record of the persons in the sample and their spouses. The RHS is a national longitudinal survey of more than 11,000 nonmarried men and women and married men aged 58–63. It contains information on work patterns, health, living arrangements, financial resources and assets, expenditures, and retirement plans.

For purposes of this study, only married couples with both spouses present were used (7,043 couples in 1969). When self-employed couples eventually were eliminated from the analysis, the sample was reduced to about 5,000.

The sample was 91 percent white, and the average individual had a tenth-grade education.

Some variables were transferred directly from the RHS data file but most were constructed to meet the specific purposes of this study. Definitions and descriptions of all the variables used in the analysis appear in the technical note to this article.

A separate analysis was performed for each available year of data. The estimating process proceeded in two stages. The lack of current wage data on nonworking individuals necessitated the estimation of wage equations from the subset of working individuals to impute wages to the sample as a whole. The results of these estimations and the variable means for this working subset are given in the technical note.

The labor-force participation equations were estimated by the use of a multivariable log-linear logistic model. The technique used is a modified version of the procedures described by Nerlove and Press.[1] The results from these estimations are presented in tables 2, 4, and 5. The numbers that appear in the coefficient columns are the estimated coefficients for the logit model. The derivative columns indicate the change in the probability of labor-force participation for a one-unit change in the exogenous variable when the other variables are held constant at their means. It is a total marginal effect that includes direct effects from the individual's own equation and indirect effects from the spouse's equation. The derivative therefore will not necessarily have the same sign as the logit coefficient. The variable "spouse's labor-force participation" is the interaction between the two equations. In this model, the coefficient is constrained to be the same in both equations. It is questionable that the effect of the husband's work time on the wife's work time would be the same as the effect of the wife's work time on the husband's. The means of the variables used in these estimations appear in the technical note.

Labor-Force Participation in 1969

The empirical analysis of retirement begins with the estimation of the simultaneous labor-force participation decision for husbands and wives in 1969. The decision by an individual to withdraw from the labor force is a function of personal, financial, and pension variables along with the current labor-force status of one's spouse. The results of these decisions are shown in table 2.

The personal characteristics hypothesized to influence labor-force participation are the age and age squared of the husband and wife, the number of children supported by the couple, and the number of dependent parents in the household. The individual's age is included in both equations to capture the effect of declining participation with age that is not explained by the other explanatory variables. The age-squared term allows for a nonlinear relationship with age. The age of the spouse is also used as an independent variable to test whether it influences retirement. Of these four variables used in each equation, only the wife's age in her equation was significant. This finding is attributable in part to the greater variation in the age of the wives in the sample.

[1]Marc Nerlove and S. James Press, **Univariate and Multivariate Log-Linear and Logistic Models,** Rand Corporation, 1973.

Table 2.—Husband's and wife's simultaneous labor-force participation

Explanatory variable	Labor-force participation			
	Husband's		Wife's	
	Coefficient [1]	Derivative of probability at mean	Coefficient [1]	Derivative of probability at mean
Intercept	4.618 (.10)	....	-28.0830	....
Wages:				
Wife's	[2] -.599 (3.38)	-0.1055	[2] 2.9892 (20.73)	1.1302
Husband's	[2] .9223 (6.45)	.2110	[2] -1.5487 (13.88)	-.5758
Home equity	[2] -.0058 (2.69)	-.0015	[3] -.0042 (2.31)	-.0017
Assets	[2] -.0315 (3.83)	-.0092	[2] -.0691 (4.18)	-.0269
Husband's disability income	[2] -.3448 (2.81)	-.0924	[2] -.2715 (3.40)	-.1090
Welfare income	[3] -.4458 (2.01)	-.1191	[4] -.3303 (1.80)	-.1330
Husband's:				
Age	-.0605 (.04)	-.0068	.5431 (.44)	.2061
Age squared	-.0006 (.05)	-.0002	-.0043 (.43)	-.0016
Wife's:				
Age	.0422 (.74)	.0187	[2] -.4977 (8.42)	.1904
Age squared	-.0002 (.40)	-.0001	-.0057 (9.48)	-.0022
Children	[2] .1497 (4.15)	.0380	-.0153 (.61)	-.0034
Parents	-.0769 (.55)	-.0196	-.0001 (.001)	-.0013
HESS	-.1202 (1.05)	-.0319	-.0112 (.12)	-.0062
WESS	-.1135 (1.06)	-.0341	[3] -.2123 (2.21)	-.0764
SSWH	[2] -.0350 (1.81)	.0085	[2] -.0248 (13.83)	-.0089
SSWW	[4] -.0212 (1.81)	-.0028	[2] .1621 (13.83)	.0615
HEP	[2] -.5602 (8.57)	-.1752	[2] -.2006 (3.84)	-.0823
WEEP	-.0048 (0.05)	.0148	[2] .7211 (8.73)	.3291
PWH	-.0002 (.38)	.0000	.0001 (.30)	.0000
PWW	.0075 (1.32)	.0019	-.0031 (.60)	-.0011
Health:				
2	[3] -.2948 (2.52)	-.0905	-.00220 (.22)	-.0138
3	[2] -1.9357 (26.42)	-.7215	-.0552 (.66)	-.0636
Spouse's LFP	[3] .8688		[3] .8688	

N [5] 3,312
L [6] -2325.2317

[1] The t statistics shown in parentheses.
[2] Significant at 1-percent level of confidence.
[3] Significant at 5-percent level of confidence.
[4] Significant at 10-percent level of confidence.
[5] Equals the number of observations used in the estimation.
[6] Log likelihood of equation.

A common finding in the labor-supply literature is that dependents in the family tend to increase market work by the husband and decrease labor-force participation by the wife. In 1969, the more children being supported the more likely the men in the sample were to be in the labor force. Although the coefficients are not significant, women were less likely to participate in market work if they had dependent children or parents in the home.

Health is an important determinant in retirement decisions. A significant shortcoming of the RHS is the lack of health data on the wives. The health status of men as measured by the Duke Health Index[2] is highly significant and indicates that health impairments can sharply reduce labor-force participation. A move from relatively good health (categories 1 or 2) to rather mild health impairments (indicated by a ranking of 3), for example, lowers the probability of being in the labor force by 9.5 percentage points; a fall from the top ranks to the severe limitations exhibited at the bottom of the index reduces the likelihood of participation by 72.2 percentage points. The significance of the disability-income variable may also indicate the importance of health to the retirement decision.

The husband's poor health might influence his wife to increase her market work to provide income for the family. On the other hand, she might stay home to care for her husband. The estimated coefficient indicates that this effect may dominate slightly, although it is insignificantly different from zero. The availability of disability income to the husband is an important factor in determining the wife's decision because compensation for disabilities increases the probability that she will remain at home.

The financial variables include the estimated market value of the husband's and wife's time and the extent of other income available to the family. The theoretical relationship between own wages and those of the spouse is ambiguous. This ambiguity exists because the stocks of human capital possessed are endogenously determined by the investments made earlier in life. In both equations, the own-wage variable is positive and significant, indicating that higher wages increase the probability of participation. For women, a 10-percent increase in wages increases their probability of being in the labor force by 31.7 percent; a 10-percent increase in wages for men raises the probability of the husband being in the labor force by 2.85 percent. By contrast, the coefficient on spouse's wage is negative in both equations, indicating that increases in the wage of one's spouse decrease the likelihood that a person will remain in the labor force. These findings are qualitatively consistent with a comparison of charts 1 and 3.

The existence of income not related to work in this period would be expected to reduce labor-force participation. This effect is confirmed by the significant negative values on the home-equity and income-from-asset variables. Work restrictions may be tied to the receipt of welfare and disability income, which may affect these coefficients (significantly negative in both equations).

The pension variables in this analysis are current eligibility for and present value of social security and employer pension benefits. In a life-cycle model with perfect credit markets such as the simulation model used here, current eligibility for retirement benefits should not alter a person's labor-supply decision. If there are limits on credit and/or if borrowing rates exceed lending rates, this variable would affect access to such benefits and thus would be expected to reduce labor-force participation. The coefficient on husband's eligibility for social security benefits is negative but insignificant in both equations; the wife's eligibility significantly lowers her participation probability by 8 percentage points. By contrast, the husband's eligibility for employer pension benefits significantly lowers his participation rate by 17.5 percentage points and that of his wife by 8.2 points. All of the current eligibility coefficients are negative except for the wife's current pension eligibility. While her eligibility reduces the participation of the husband, her participation is significantly higher if she will at some point become eligible for retirement benefits. In the equation for the wife, this variable is probably serving as a proxy for a career orientation on her part that would have produced a sufficient number of years in the labor force to acquire vested pension benefits.

Unanticipated increases in the value of social security benefits at retirement are expected to reduce labor-force participation. The variable in the equations, however, is the value of the known stream of benefits available to a person at a particular time. This benefit is determined by past market work and as such is not the same as an unexpected change in these benefits. The use of the actual present value of the social security benefits of the husband indicates that higher social security wealth increases his participation but reduces that of his spouse. The coefficient in the wife's equation of her husband's social security wealth should be unaffected by the problem noted above. The social security wealth of the wife has comparable effects, that is, it increases her participation but reduces his. Each of these coefficients of social security wealth is significant but none of the pension wealth coefficients are significant.

This estimation procedure allows the retirement decision to be a function of the work experience of one's spouse. Within the family framework, it seems logical that time allocation decisions are jointly determined. Throughout this analysis, the labor-force participation of an individual's spouse always was significantly and positively associated with that individual's own work decisions.

[2] G. G. Fillenbaum and George Maddox, **Assessing the Functional Status of LRHS Participants** (Technical Report No. 2), Center for the Study of Aging and Human Development, Duke University, September 1977. See page 15 of this article for a brief explanation of the index.

The Wage Variable and Retirement

The determination of the appropriate wage to be assigned workers currently not in the labor force constitutes a statistical and theoretical problem in estimating labor-force participation equations. In the preceding section, the wage for all individuals was imputed on the basis of wage equations shown in the technical note. In these equations, tenure on one's present job is always positively related to the wage and highly significant. The estimated wage for the employed is obviously derived through the use of current job tenure. More difficult conceptual issues are encountered when the wage for those now out of the labor force is imputed.

The appropriate use of tenure in the wage equation depends on the question being asked. If the objective is to attempt to explain why individuals have left their last job, then the wage that was rejected is based on tenure in that last job.

In the analysis above, tenure was used in the following fashion. For persons employed in 1967, the expected wage in 1969 from continued work on the previous job would be the appropriate variable. Thus, the predicted wage for 1969 is determined using 1967 tenure for those persons employed in 1967. By contrast, the actual wage a person who has left the labor force can command is based on zero tenure with all other employers. If the individual could return to the previous employer, the expected wage would be based on the tenure he had accrued before leaving and allowing for the depreciation of skills. The assignment of zero tenure to persons outside the labor force systematically lowers their wage in relation to the use of tenure on their last job and, as a result, increases the estimated own-wage elasticities in both equations (see table 3). Although the magnitudes of the other explanatory variables are altered, their signs and levels of significance are generally unchanged.

The above discussion implies that the estimation of a labor-force participation equation confounds two separate questions. Some persons are deciding whether to leave existing jobs while others are seeking to reenter the labor force. These questions could be more correctly addressed by dividing the sample into those who were employed in the preceding period and those who were previously out of the labor force. This procedure has been applied to men in a single equation framework but additional data and theoretical problems arise in the simultaneous model.

Table 3.—Wage elasticities of husband's and wife's labor-force participation, by alternative definitions of job tenure,[1] 1969

Explanatory variable	Labor-force participation			
	Husband's tenure		Wife's tenure	
	On previous job [2]	Zero [3]	On previous job [2]	Zero [3]
Wages:				
Husband's	0.2853	0.6612	-2.5814	-2.9913
Wife's	-.0774	-.2061	3.1679	3.2759

[1] Employed persons are assigned tenure ontheir current job.

[2] Persons out of the labor force are assigned their tenure on the previous job if they were employed in 1967; otherwise tenure equals zero.

[3] Persons not employed are assigned a tenure of zero.

Aging of RHS Cohort

The 1969 RHS data include 7,043 married men aged 58-63 who were living with their wives. The number of couples declined to 6,228 in 1971 and to 5,528 in 1973. During this period, the average age of the wives rose from 54.5 to 60.4. The aging of the cohort was associated with a decline in the labor-force participation of its members, as shown below.

Couples	Labor-force participation rate		
	1969	1971	1973
Husbands	76.0	63.5	39.3
Wives	32.6	31.9	26.0

As a cohort ages and an increasing proportion of its members permanently leave the labor force, the conceptual issues raised in the preceding section increase in importance. This article does not attempt any further division of the sample on the basis of market experience in the preceding period. Instead, the same model is estimated for each of the three survey years. The results are shown in tables 4 and 5.

The qualitative results are reasonably stable over the period. Only five of the derivatives in the wife's equation change signs; in each instance, the coefficient is insignificant for that year. Only six sign changes occur in the husband's equation and all but two are for variables that have insignificant coefficients.

With only the exception of the wife's wage in the husband's equation for 1973, the wage coefficients are highly significant and of similar signs throughout the period. The implied wage elasticities for each year are shown in table 6. Although income from assets is highly significant and negative in both equations for all years, less consistency is apparent in the estimates for the other income variables (tables 4 and 5). Throughout the period the health of the husband is an important determinant of labor-force participation. As the cohort of men ages, minor health limitations become an increasing deterrent to their continued employment. At no time does the health of the husband significantly alter the wife's work decision.

Social security and pension characteristics remain important throughout the 4-year period. Of the social security eligibility variables, only the wife's eligibility in her equation is significant. Consistently, the present

Table 4.—Wife's labor-force participation, 1969, 1971, and 1973

Explanatory variable	1969 Coefficient [1]	1969 Derivative of probability at mean	1971 Coefficient [1]	1971 Derivative of probability at mean	1973 Coefficient [1]	1973 Derivative of probability at mean
Intercept	-28.0830	....	0.3516	....	-49.8467	....
	(0.75)		(0.007)		(1.08)	
Wages:						
Wife's	[2] 2.9892	1.1302	[2] 1.8395	0.6531	[2] 1.9653	0.5343
	(20.73)		(10.96)		(12.28)	
Husband's	[2] 1.5487	.5758	[2] .7570	.2393	[2] .6369	.1472
	(13.88)		(5.30)		(4.98)	
Home equity	[3] .0042	.0017	-.0016	.0006	.0015	.0003
	(2.31)		(.70)		(1.18)	
Assets	[2] .0691	.0269	[2] .0688	.0272	[2] .0863	.0256
	(4.18)		(3.69)		(4.31)	
Husband's disability income	[2] .2715	.1090	.0325	.0522	[4] .0667	.0042
	(3.40)		(.70)		(1.95)	
Welfare income	[4] .3303	.1330	.1649	.0743	[2] .9459	.2782
	(1.80)		(.68)		(3.10)	
Husband's:						
Age	.5431	.0261	.2992	.1520	1.1590	.2850
	(.44)		(.18)		(.81)	
Age squared	.0043	.0016	.0027	.0012	.0088	.0022
	(.41)		(.20)		(.79)	
Wife's:						
Age	[2] .4977	.1904	[2] .3407	.1282	[2] .4641	.1294
	(8.42)		(5.08)		(6.96)	
Age squared	[2] .0057	.0022	[2] .0038	.0014	[2] .0048	.0013
	(9.48)		(5.90)		(7.52)	
Children	.0153	.0034	.0151	.0038	.0579	.0179
	(.61)		(.42)		(1.39)	
Parents	.0001	-.0013	[2] .3187	.1214	.0334	-.0131
	(.001)		(2.03)		(.20)	
HESS	.0112	.0062	.0203	.0136	.1543	.0375
	(.12)		(.18)		(.99)	
WESS	[3] .2123	.0764	[2] .5301	.1764	[2] .3639	.0959
	(2.21)		(4.70)		(3.88)	
SSWH	[2] .0248	.0089	[2] .0266	.0083	[2] .0249	-.0067
	(5.34)		(4.93)		(5.11)	
SSWW	[2] .1621	.0615	[2] .1059	.0380	[2] .0531	.0142
	(13.83)		(9.91)		(8.53)	
HEP	[2] .2006	.0823	.0033	.0200	[2] .2027	.0304
	(3.84)		(.05)		(2.81)	
Health:						
2	-.0220	-.0138	.0466	-.0214	-.1232	-.0568
	(.22)		(.43)		(1.23)	
3	.0552	.0636	.0837	.0294	.0499	.0359
	(.66)		(.83)		(.62)	
PWH	.0001	.0000	[2] .0108	.0045	[2] .0077	.0026
	(.30)		(5.36)		(4.47)	
PWW	.0031	.0011	[2] .0181	.0069	[2] .0252	.0072
	(.60)		(3.43)		(5.20)	
WEEP	[2] .7211	.3291	[2] .8280	.3665	[2] .4606	.1525
	(8.73)		(7.75)		(4.85)	
Wife's disability income	....	....	[2] -.6947	.2756	[2] .6298	.1812
			(2.62)		(4.51)	
Husband's LFP	[3] .8688	....	[2] .1946	....	[2] .1769	....
N [5]	3,312		2,170		2,174	
L [6]	2325.23169		1936.88436		2014.62113	

[1] The t statistics shown in parentheses.
[2] Significant at 1-percent level of confidence.
[3] Significant at 5-percent level of confidence.
[4] Significant at 10-percent level of confidence.
[5] Equals the number of observations used in the estimation.
[6] Log likelihood of equation.

Table 5.—Husband's labor-force participation, 1969, 1971, and 1973

Explanatory variable	1969 Coefficient [1]	1969 Derivative of probability at mean	1971 Coefficient [1]	1971 Derivative of probability at mean	1973 Coefficient [1]	1973 Derivative of probability at mean
Intercept	4.6180	....	[2] -129.4746	....	30.0525	....
	(0.10)		(2.31)		(.70)	
Wages:						
Wife's	[3] -.5990	-0.1055	[3] .4848	.1098	.2019	.0015
	(3.38)		(2.89)		(1.44)	
Husband's	[3] .9223	.2110	[3] .6809	.2657	[3] .6460	.2481
	(6.45)		(4.77)		(5.50)	
Home equity	[3] .0058	.0015	.0004	-.0003	[4] -.0024	-.0010
	(2.69)		(.26)		(1.80)	
Assets	[3] .0315	-.0092	[3] -.0270	.0166	[3] -.0383	-.0203
	(3.83)		(3.31)		(3.26)	
Husband's disability income	[3] -.3448	.0924	[3] -.6579	.3034	[3] -.5062	-.2137
	(2.81)		(8.30)		(6.33)	
Welfare income	[2] -.4458	.1191	.2149	.1086	[4] -.3724	.2018
	(2.01)		(.92)		(1.65)	
Husband's:						
Age	.0605	.0068	[2] 4.3045	1.9540	-.7928	-.2876
	(.04)		(2.42)		(.60)	
Age squared	.0006	.0002	[2] -.0360	.0163	.0048	.0017
	(.05)		(2.54)		(.47)	
Wife's:						
Age	.0422	.0187	.0287	.0339	.0247	.0313
	(.74)		(0.53)		(.49)	
Age squared	.0002	.0001	.0002	.0003	-.0002	.0003
	(.40)		(.34)		(.54)	
Children	[3] .1497	.0380	.0287	.0122	.0425	.0208
	(4.15)		(.63)		(1.04)	
Parents	.0769	-.0196	.0510	-.0429	-.0871	-.0388
	(.55)		(.32)		(.53)	
HESS	.1202	-.0319	[3] -.3560	-.1574	-.0453	-.0131
	(1.05)		(2.83)		(.29)	
WESS	.1135	-.0341	-.0837	-.0676	.0334	-.0015
	(1.06)		(.87)		(.41)	
SSWH	[3] .0350	.0085	[3] .0265	.0105	.0045	.0008
	(6.06)		(4.75)		(.97)	
SSWW	[4] -.0212	.0028	[2] .0212	.0033	[4] -.0103	.0020
	(1.81)		(2.26)		(1.86)	
HEP	[3] .5602	-.1752	[3] .3676	.1589	[3] .5250	.2322
	(8.57)		(5.09)		(8.40)	
Health:						
2	[2] .2948	.0905	[3] .5803	.2781	[3] .8957	.2725
	(2.52)		(5.91)		(8.44)	
3	[3] -1.9357	.7215	[3] .9243	.4269	[3] .6105	-.2233
	(26.42)		(9.68)		(7.85)	
PWH	.0002	.0000	[3] .0080	.0043	[3] .0104	-.0048
	(.38)		(5.92)		(7.82)	
PWW	.0075	.0019	-.0024	-.0022	-.0057	-.0036
	(1.32)		(.62)		(1.33)	
WEEP	.0048	.0148	-.0876	.0234	-.0877	-.0123
	(.05)		(.80)		(.93)	
Wife's: disability income	....	....	-.2908	-.1757	-.1584	-.0960
			(1.69)		(1.48)	
LFP	[3] .8688	....	[2] .1946	....	[2] .1769	....
N [5]	3,312		2,170		2,174	
L [6]	2325.23169		1936.88436		2014.62113	

[1] The t statistics shown in parentheses.
[2] Significant at 5-percent level of confidence.
[3] Significant at 1-percent level of confidence.
[4] Significant at 10-percent level of confidence.
[5] Equals the number of observations used in the estimation.
[6] Log likelihood of equation.

value of spouse social security benefits is highly significant and negative in both equations. For the husband, the wealth value of his own benefits becomes smaller and less significant in the later periods. For the wife, the 1973 estimate of the effect of her own social security wealth is significantly negative. These findings imply that the market orientation that produces large social security benefits reduces the tendency toward early retirement but may be associated with greater retirement rates at approximately age 65.

The present value of the husband's benefits from employer pensions is significant in both equations in 1971 and 1973 but insignificant in 1969. The coefficient of the value of the wife's benefits is consistently negative but is significant only in her equations for 1971 and 1973. Thus, private pension wealth becomes a more significant determinant of labor-force withdrawal as the cohort ages. The own-eligibility coefficients are less easy to interpret because they are positive and significant in five of the six cases.

Conclusions

The results presented here are from an investigation of family retirement decisions. The first section describes a simulation model of the life-cycle allocation of family time and assets. The sensitivity of hours of work, expenditures, and wealth to changes in home and market productivity of each spouse is illustrated. The allocation of time is also responsive to the real rate of interest.

In the next section, the Retirement History Study is employed to estimate labor-force participation equations employing variables implied by the simulation model. The decision to remain in the labor force is found to be positively related to the individual's own wage and negatively related to the spouse's wage. The health of the husband is an important determinant of his wage and participation. Wealth and asset income reduce the likelihood of continuing market work. Because of the relationship to past market work, the pension variables are generally less significant. Current labor-force participation of the spouse contributes significantly to the probability that an individual will be in the labor force.

In general, the logit results are consistent with the predictions from the simulation of life-cycle behavior. Market wages are determined in the model by the stock of human capital (endogenously determined by individual investment decisions) and its rental rate (exogenously set in the labor market). As a result, a change in any of the parameters of the model will alter the investment pattern and therefore the wage rate and labor supply. For wages late in an individual's worklife, the differences in the RHS are reflections of these different patterns of investment.

A comparison of charts 1 and 3 reveals that the effect of reducing spouse 2's market rental rate is to lower slightly spouse 2's retirement age while delaying the labor force withdrawal of spouse 1. This finding is supported throughout the logit analysis since the own-wage coefficients are always positive and significant while the spouse wage coefficients are negative and significant. Chart 4 illustrates that a similar result is achieved from increasing spouse 2's comparative advantage in home production. Chart 5 shows that the combination of these two effects significantly reduces spouse 2's total time in the market.

Table 6.—Wage elasticities, 1969, 1971, and 1973

Explanatory variable	1969	1971	1973
Wife's wages/husband's equation	-0.0774	0.1364	-0.0044
Husband's wages/husband's equation	.2853	.5051	1.0006
Wife's wages/wife's equation	3.1679	2.1245	2.9761
Husband's wages/wife's equation	-2.5814	-1.1913	-1.1122

Although they are not shown in the text, earlier simulations confirmed an unambiguous reduction in market work with increases in the initial stock of bonds. This anticipated wealth effect is also found in the logit analysis even though much of the variation in the stock of wealth at age 60 is due to life-cycle savings decisions and not unexpected changes in one's assets.

The simulations illustrated in charts 1, 3, and 5 indicate that the comparative advantage of one spouse in market work tends to result in the greater specialization of the time of family members. Similarly, charts 1, 4, and 5 reveal a comparable result for shifts in relative home productivity. At first, these movements may seem to be at odds with the positive correlation between spouse labor-force participation found in the logit analysis. The apparent contradiction is resolved by comparing chart 2 with chart 1, where the only variation in the base case is a reduction in the real interest rate. In this example, the parameter change does not involve the value of either spouse's time in the home or market.

The simulation and the logit analysis strongly support the hypothesis that retirement is a family decision. The personal and market characteristics of the spouse significantly influence an individual's decision to withdraw from the labor force. To the extent that data are available, future studies should attempt to include spouse variables in retirement equations. They should also put greater emphasis on the background of both husband and wife.

Technical Note

Definitions and descriptions of the variables used in analyzing labor-force participation follow.

Definitions of Variables

Dependent: 1 if individual was working, had a job but was not at work, or was looking for work; 0 otherwise

Demographic:
Age—individual's age
Age Squared—square of individual's age
Education—years of education completed
Race—1 for white; 0 for nonwhite
Children—number of children supported completely
Parents—number of parents living in the household

Labor-market and job characteristics:
Urbanization dummy 1 (URBAN 1)—1 if individual was living in urbanized area with population greater than 3,000,000; 0 otherwise
Urbanization dummy 2 (URBAN 2)—1 if individual was living in urbanized area with population of 1,000,000-2,999,999; 0 otherwise
Urbanization dummy 3 (URBAN 3)—1 if individual was living in urbanized area with population of 250,000-999,999; 0 otherwise
Urbanization dummy 4 (URBAN 4)—1 if individual was living in urbanized area with population of less than 250,000; 0 otherwise
Government worker—1 if individual was government worker; 0 otherwise

Market earnings:
Wage—individual's imputed hourly wage in log dollars from wage-equation estimations

Wealth:
Home equity—market value of home minus size of mortgage in thousands of dollars
Assets—combined family income from assets in thousands of dollars

Pension variables:
Social security (SSW)—present discounted value of all social security retired-worker, spouse, and survivor benefits in thousands of dollars
Private pensions (PW)—present discounted value of pension benefits in thousands of dollars
Social security eligibility (ESS)—1 if individual currently eligible to receive social security benefits; 0 otherwise
Pension eligibility (EP)—1 if individual currently eligible to receive private pension; 0 otherwise

Nonmarket income:
Welfare income—combined family welfare income in thousands of dollars
Disability income—individual's disability income in thousands of dollars

Health:
Health dummy 1 (HEALTH 1)—1 if individual received a 1, 2, or .G in the health index (health better or same as that of others); 0 otherwise
Health dummy 2 (HEALTH 2)—1 if individual received a 3 in the health index (health worse than that of others but can work full time)
Health dummy 3 (HEALTH 3)—1 if individual received a 4, 5, or .P in the health index (poor health, can work part time or not at all); 0 otherwise

Market experience:
Tenure—individual's tenure on current job or, if not working and had worked within preceding 2 years, equal to tenure on that job; 0 otherwise

Descriptions of Variables

Wage. The wage variable is a predicted wage derived from the wage equations shown in tables I and II. For workers not in the labor force a question of the value of the tenure variable arises. If workers are rejecting a wage to reenter the labor market, the tenure variable should be zero. If, however, they have recently left the labor force, the wage they are rejecting may be the wage from their previous job, in which case tenure should be the tenure from that job. The wage variable is therefore imputed by two methods. In one computation, tenure is zero for all individuals not in the labor force. In the second computation, tenure is equal to the tenure from the previous job if the individual has been out of the labor force for less than 2 years; otherwise, it is zero.

Wealth. The asset variable is total family income from interest, dividends, rent, private annuities, contributions from outside the household, and contributions from children aged 18 and over. Income from assets rather than actual assets is used because no asset information was provided in the 1973 wave.

Pension. Social security wealth is the present value of future benefits deferred to age 62, if the individual had not yet reached age 62.

$$\text{PVSS} = \frac{e^{(-rM)}(1-e^{(-rN)})}{r} \cdot \text{MBA}$$

where r = .03;
M = number of payments based on remaining years of life, race, and sex;
N = number of years until benefit eligibility;
MBA = monthly benefit amount, computed by adjusting the primary insurance amount for age at retirement.

If the individual begins receiving social security benefits at ages 62, 63, or 64, the payment is reduced 90/600 for each year he is under age 65. The benefit is increased 1 percent for each year retirement is delayed from age 65 to 72. If an individual is younger than his or her spouse, the individual's social security wealth contains a spouse's benefit until the individual becomes eligible for a retired-worker benefit. Survivor benefits are also included at 82.5 percent of the spouse's benefit.

Pension wealth is calculated as the present value of pension benefits at the individual's expected retirement age plus the present discounted value of pensions currently received.

Table I.—Husband's wage equation,[1] 1969, 1971, and 1973

Explanatory variable	Coefficients [2]		
	1969	1971	1973
Intercept	[3] 20.3192	14.6173	1.6793
	-(2.06)	(0.96)	(0.06)
Age	[4] .69001	.4959	-.0222
	(2.11)	(1.02)	(-.02)
Age squared	[4] .0058	-.0041	.00002
	-(2.13)	-(1.05)	(.002)
Education	[3] .0506	[3] .0504	[3] .0543
	(25.71)	(19.24)	(13.37)
Race	[3] .1962	[3] .2348	[3] .2656
	(7.89)	(6.89)	(5.41)
Urban:			
1	[3] .2617	[3] .2822	[3] .3245
	(14.34)	(11.45)	(8.35)
2	[3] .2108	[3] .2422	[3] .2675
	(9.50)	(7.73)	(5.42)
3	[3] .1327	[3] .1047	[3] .0875
	(6.49)	(3.83)	(2.03)
4	[3] .0733	[3] .0875	[3] .1002
	(3.22)	(2.78)	(2.02)
Tenure	[3] .0087	[3] .0089	[3] .0089
	(17.13)	(13.20)	(8.48)
Health:			
3	.0103	[4] -.0857	[3] -.1075
	(-.35)	-(2.04)	(1.37)
4	[4] -.0818	[3] -.1360	[3] -.1672
	(-2.14)	-(2.63)	(-2.83)
Government worker	.0188	[3] .1330	[3] .2043
	(1.09)	(3.99)	(3.94)

[1] Regression estimated by using ordinary least squares. Excludes individuals who had hourly wages less than $1 or greater than $50.
[2] The t statistics shown in parentheses.
[3] Significant at 1-percent level of confidence.
[4] Significant at 5-percent level of confidence.

Table II.—Wife's wage equation,[1] 1969, 1971, and 1973

Explanatory variable	Coefficients [2]		
	1969	1971	1973
Intercept	0.3643	0.5190	[3] 1.7066
	(0.76)	(0.74)	(1.82)
Age	-.0167	-.0181	[3] -.0582
	(-.93)	(-.70)	-(1.71)
Age squared	.0001	.0001	[3] .0005
	(.79)	(.61)	(1.65)
Education	[4] .0494	[4] .0648	[4] .0669
	(17.17)	(16.57)	(11.93)
Tenure	[4] .0104	[4] .0092	[4] .0091
	(11.44)	(6.90)	(5.08)
Race	[4] .1401	.0621	[3] .0892
	(4.52)	(1.46)	(1.68)
Urban:			
1	[4] .2618	[4] .2751	[4] .2038
	(11.62)	(7.83)	(4.21)
2	[4] .1786	[4] .1484	[4] .1075
	(6.40)	(3.57)	(1.86)
3	[4] .0831	[5] .0861	.0812
	(3.30)	(2.35)	(1.63)
4	.0289	.0400	-.0118
	(1.08)	(.94)	(-.21)
Government worker	[4] .1890	[4] .2812	[5] .1561
	(9.06)	(5.21)	(2.18)

[1] Regression estimated by using ordinary least squares. Excludes individuals who had hourly wages less than $1 or greater than $50.
[2] The t statistics shown in parentheses.
[3] Significant at 10-percent level of confidence.
[4] Significant at 1-percent level of confidence.
[5] Significant at 5-percent level of confidence.

$$PVPEN = \frac{(1-e^{(-qT)})}{q} \cdot ABEN + \frac{e^{(-rM)}(1-e^{(-qN)})}{q} \cdot EBEN$$

where q = .08,
T = remaining years of life,
ABEN = current pension benefits,
r = .03,
M = number of payments based on expected time of retirement and remaining years of life,
N = number of years until benefit eligibility, and
EBEN = expected benefits.

This calculation assumes an expected rate of inflation of 5 percent and no indexing of benefits. If the expected age of retirement is missing, an expected retirement age of 65 is assumed. Since expected and actual pension benefits are lumped together for husband and wife in the 1969 wave, 1971 data are used for the 1969 pension-wealth variable. In cases where the wife was succeeded by another between 1969 and 1971, the 1971 value for the husband is subtracted from the 1969 value for the husband and wife, and the remaining value is attributed to the pension wealth of the wife in 1969.

Two eligibility variables are used. Individuals are considered currently eligible for social security benefits if they are at least aged 62 and have 40 or more quarters of coverage as computed from the summary earnings record. Current pension eligibility is determined from responses to questions on the age at which the individiual would be eligible to receive full or partial pension benefits based on their current, previous, and longest jobs. Since spouses were asked this question only in the 1971 wave, 1971 responses were used to compute the current pension eligibility of wives for all 3 years.

Nonmarket income. Disability income includes aid to the blind and aid to the permanently and totally disabled, state cash sickness benefits, worker's compensation, disability benefits under the social security program, and other disability pensions. For the 1969 wave, data for the respondent and spouse are lumped together.

Welfare income includes income from aid to families with dependent children, old-age assistance, other public assistance programs, and private welfare agencies. Data for respondents and spouses are summed for the 1969 wave.

Health. Health is measured on the basis of the Duke Health Index.[3] This index attempts to rate an individual's overall physical health on the basis of responses to a series of questions. It should be an objective measure of physical health since it has been shown to be consistent with physician's ratings. The index assignments and corresponding health conditions are as follows:

[3] Ibid.

Rating	Condition
1	Self-assessed health better than that of others; no mobility or activity limitations, full-time work possible or being performed.
2	Self-assessed health better than that of others, or same as that of others; may have some mobility or activity limitations but can, or does, work full time.
3	Self-assessed health worse than that of others; may have some mobility or activity limitations but can, or does, work full time.
4	At most, may be able to work part time; unable to go outside and/or use public transportation unaided but is not housebound.
5	Cannot, and does not, do any work; housebound.

When some information is missing, respondents without mobility or activity limitations are assigned a . G . A . P is assigned to respondents who spent 14 days or more in the hospital or were receiving disability payments.